

Why are stocks so risky?

Authors: Richard W. Kopcke, Dan Muldoon

Persistent link: <http://hdl.handle.net/2345/bc-ir:104282>

This work is posted on [eScholarship@BC](#),
Boston College University Libraries.

Chestnut Hill, Mass.: Center for Retirement Research at Boston College, November 2009

These materials are made available for use in research, teaching and private study, pursuant to U.S. Copyright Law. The user must assume full responsibility for any use of the materials, including but not limited to, infringement of copyright and publication rights of reproduced materials. Any materials used for academic research or otherwise should be fully credited with the source. The publisher or original authors may retain copyright to the materials.

WHY ARE STOCKS SO RISKY?

BY RICHARD W. KOPCKE AND DAN MULDOON*

Introduction

With the decline in privately and publicly guaranteed benefits for pensions and health care, people increasingly must finance a greater share of their retirement expenses through their own savings. The relatively high long-term return on equity makes investments in stocks seem both an attractive and suitable means of accumulating the substantial wealth that savers will require. Yet, the 50 percent drop in the Standard & Poor's 500 Index from May 2008 to March 2009 is only the latest reminder that stocks pose considerable risk for investors. In the past, equity returns over periods as long as 10 or 20 years have diverged substantially from their long-term averages, tarnishing the appeal of stocks even as investments for the long run.

This *brief* analyzes the risk in stocks, partitioning it into two components. The first reflects the growth of economic activity and corporate earnings. The second reflects the way investors value those earnings. This analysis finds that variations in business activity and profits – the first component – account for a relatively small share of the risk in stocks over holding periods as long as 10 years. Instead, variations in shareholders' valuation of earnings account for most of the volatility of returns. This *brief* also

finds that the risk attributed to valuations of earnings tends to diminish over investment horizons as long as 40 years or more, because the value of stocks broadly follows the trend in GDP and corporate profits. Although stocks are better investments for the very long run, these periods can seem *too long* to suit savers who lack the capacity or the willingness to absorb significant financial risks in the interim.

This *brief* is the first in a series that will examine the potential role of stocks as long-term investments for savers. Future *briefs* will analyze the outlook for the long-run return on stocks and the stability of those returns and examine ways of exploiting the long-run behavior of stock prices to offer savers attractive blends of returns and risks on their long-term investments.

The first section of this *brief* reviews the recent history of returns on equity. The second section notes that the market value of equity has tended to follow the trend in GDP since the 1940s. The waves of the market value of equity around this trend reflect variations in corporate earnings relative to GDP and variations in the market's pricing of earnings. The third section shows that variations in corporate earnings

* Richard W. Kopcke is a research economist at the Center for Retirement Research at Boston College (CRR). Dan Muldoon is a former CRR research associate and a current graduate student in economics at the University of Virginia.

are relatively small over holding periods as long as 10 years and that most of the risk in stocks arises from the way the market values these earnings. The final section concludes.

The Historical Record

Stocks are risky investments. Their real returns, which are highly volatile over short holding periods, also vary substantially over periods longer than a decade. We commonly measure the variability of returns by their standard deviation. A low standard deviation shows that returns do not range very far from their average value, while a high standard deviation shows that returns can extend over a large range of values. From 1949 to 2008, the average annual real rate of return on stocks was 7.2 percent (see Table 1). The standard deviation of annual returns was 18.2 percentage points.

Stockholders expect adequate compensation for bearing this risk. Accordingly, the gap between the annual return on stocks and bonds has averaged 3.8 percentage points since 1872, and 5 percentage points since 1949.¹ Some investors try to harvest this attractive premium by attempting to dilute the risk in stocks through buy-and-hold investment strategies, expecting the low and high outcomes eventually to “average out.”²

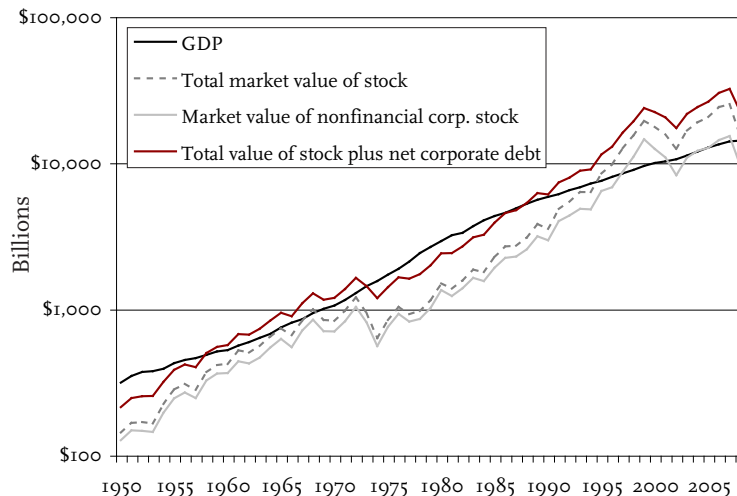
TABLE 1. ANNUAL REAL RETURNS ON MARKET SECURITIES, 1872-2008

Years	Equities		Bonds	
	Average return	Std. dev.	Average return	Std. dev.
1872-2008	6.1 %	19.1%	2.3 %	8.4%
1949-2008	7.2	18.2	2.2	9.9
1949-1958	17.9	19.9	-0.5	4.6
1959-1968	7.8	13.1	0.6	4.4
1969-1978	-3.3	19.6	-1.4	8.5
1979-1988	11.0	13.1	5.0	17.7
1989-1998	15.6	14.9	7.4	9.6
1999-2008	-3.8	19.6	2.2	6.9

Sources: Global Financial Data (2009); Ibbotson Associates (2009); and U.S. Board of Governors of the Federal Reserve System (2009).

The historical record, however, shows that the risk in stocks is not so easily tamed. Although the variation of average annual returns diminishes over 10-year holding periods, it subsides too little to suggest that high and low annual returns offset each other very effectively (see Table 1).³

FIGURE 1. GDP AND VALUE OF CORPORATIONS' MARKETABLE SECURITIES, 1950-2009 Q1



Note: The data in this figure use a log scale.

Sources: U.S. Board of Governors of the Federal Reserve System (2009); and U.S. Bureau of Economic Analysis (2009).

Anchors for Stock Prices

Stock prices respond both to prevailing economic conditions and to perceptions of future conditions. Consequently, both the average rate of appreciation and the variation of stock prices shift as economic conditions change, sometimes by considerable amounts.⁴ During economic booms and busts, periods of large changes in business activity, companies' earnings, and stockholders' expectations of future earnings can push the average rate of appreciation of equity well away from its historical average. At the same time, the volatility of earnings often changes significantly for intervals spanning many years. As a result of these shifts, investors cannot reliably expect high and low returns to "average out" over holding periods even as long as a decade.⁵

Just as economic conditions disturb stock prices, they also eventually help anchor stock prices. After booms and busts in business activity run their course, earnings and expectations of future earnings return to trends defined by potential GDP. This mean reversion in economic conditions and earnings also influences the value of equity, drawing the total value of stocks to a trend defined by GDP (see Figure 1).⁶ The large divergences that emerged during the energy crisis of the 1970s and during the two bull markets of the last 10 years ended as the value of stocks moved back toward their average relationship to GDP.

The Value of Equity and GDP

The correspondence between the value of stocks and GDP is more than a statistical artifact. The value of nonfinancial corporations' stocks relative to GDP can be expressed as the product of two ratios: the market value of their stock (MV) relative to their earnings (E), and their earnings relative to GDP.⁷

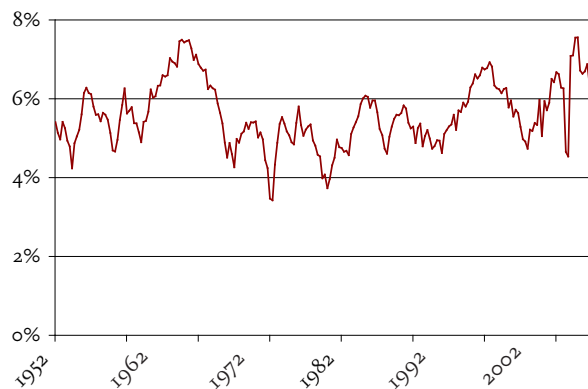
$$\frac{MV}{GDP} = \frac{MV}{E} \times \frac{E}{GDP}$$

The tie between the value of stocks and GDP consequently depends on the strength of the tie between market values and earnings – the *valuation ratio* – and on the strength of the tie between earnings and GDP – the *earnings ratio*. The discussion that follows will cover the earnings ratio first.

The Earnings Ratio

The earnings of nonfinancial corporations move relatively closely with GDP because these corporations account for a relatively stable share of GDP and the division of output between the compensation of labor and the compensation of capital for these companies has not varied substantially. The output of nonfinancial corporations has consistently accounted for just over half of GDP.⁸ Since the early 1950s, the earnings of nonfinancial corporations have mostly ranged from about 5 percent to 6 percent of GDP (see Figure 2).

FIGURE 2. EARNINGS OF NONFINANCIAL CORPORATIONS AS A PERCENT OF GDP, 1952-2009 Q1



Sources: U.S. Board of Governors of the Federal Reserve System (2009); and U.S. Bureau of Economic Analysis (2009).

Whenever earnings have deviated very much from this range, they have tended to return to it within a few years. This reversion to mean reflects a negative correlation between the growth of corporations' assets and their return on assets.⁹ When corporations' assets rise or fall much more rapidly than GDP, their rate of return on assets typically moves in the opposite direction. This negative correlation helped to stabilize the earnings ratio over longer horizons by regulating corporations' rate of expansion. When their net assets expanded faster than GDP, for instance, the falling rate of return on their assets eventually encouraged companies to reduce their capital budgets. As their rate of expansion fell, their net assets and their output fell back to their historical correspondence to GDP, and the rate of return on their assets also rose toward its historical average.

The Valuation Ratio

The valuation ratio, the first factor in the equation above, also has been anchored, albeit with a longer and more elastic tether. The ratio of market values to earnings has been more volatile than the ratio of earnings to GDP, and the deviations of valuations from average have tended to last longer than those for earnings. From 1950 to 1990, the volatility of the valuation ratio was one and a half times the volatility of the earnings ratio; after 1990, the valuation ratio was twice as volatile as the earnings ratio.

The valuation ratio depends on the return that shareholders require of stocks, companies' earnings, the outlook for future earnings, and shareholders' perception of risk, among other factors.¹⁰ When earnings surge unexpectedly, often accompanied by the adoption of new products or technologies, ratios of market values to earnings can rise as shareholders become especially optimistic about the prospects for earnings. No laws of gravity quickly pull valuations back to their mean.¹¹ During the early 1990s, for example, corporate profits rose strongly and the outlook for future earnings in the communications and technology sectors looked especially bright. Although corporate profits peaked in 1997, valuations rose for the remainder of the decade supported by forecasts of renewed growth and expectations of substantial capital gains to come.

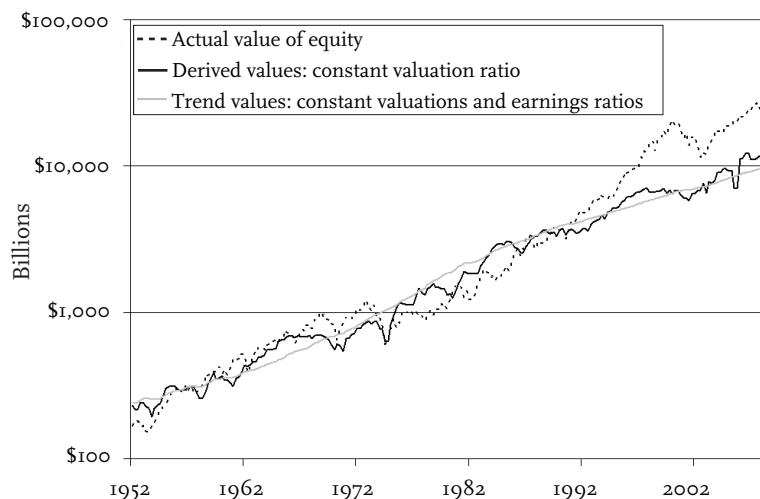
The valuation ratio eventually tends to return to its long-run average. After rising significantly during the bull market of the 1990s, the wave of optimistic valuations ended once earnings fell below trend, economic activity decelerated, and profits in the communications and technology sectors collapsed. In time, shareholders came to appreciate the tie between companies' capacity to generate profits and GDP.

We Have Met the Enemy, and It Is Us

Shareholders' reactions to economic conditions and to recent trends in stock prices create most of the volatility in the returns on equity. Although stock prices vary substantially in response to cycles in business activity and earnings, these factors account for a small share of the risk in stocks over holding periods as long as 10 years or more.

The equation described on the previous page, shows a trend line, defined by GDP, for the total market value of equity. As shown in Figure 3, if the earnings and valuation ratios always equaled their long-run averages, the total value of stocks would move in lockstep with GDP (light gray line). Along this trend, the average rate of growth of the value of stock equals that of GDP. Of course, the earnings and valuation ratios are not constant. Economic cycles bring large variations in earnings, which contribute to the volatility of stock prices. If fluctuations in

FIGURE 3. VALUATION OF EQUITY FOR NONFINANCIAL CORPORATIONS, 1952-2009 Q1



Note: The data in this figure use a log scale.

Sources: U.S. Board of Governors of the Federal Reserve System (2009); and U.S. Bureau of Economic Analysis (2009).

earnings were the sole cause of variations in stock prices, these prices would be depicted by the black line, which assumes only the valuation ratio remains constant. Instead, the actual path of equity values is depicted by the dashed line. The gaps between the black and dashed lines are due to large and lasting changes in the valuation ratio, which allow stocks to become substantially unhinged from corporations' ability to generate earnings.¹²

Conclusion

Stocks are risky investments partly because economic conditions vary in ways that we cannot fully predict. But this volatility in fundamental conditions accounts for a small share of the risk in stocks over investment horizons as long as 10 or 20 years. Most of this risk derives from the way shareholders react to their uncertainty about economic conditions, form opinions about the future, and manage their portfolios.

Over very long investment horizons, covering 40 years or more, the returns on stocks reflect economic fundamentals more consistently. Since the 1940s, the value of corporate equity has grown with GDP and corporate profits. As a result of these ties, the real rate of return on stocks over the last sixty years closely matches the growth of real GDP plus the dividend yield on stocks.

While the historical record shows that variations in the economy's potential rate of growth and return on capital have been relatively small over long intervals, these intervals can be too long to provide much assurance to investors. Furthermore, even over the very long term, shareholders bear the risk that the growth of potential GDP or the returns on companies' capital might deviate significantly from past experience. Nevertheless, the long-term risk has been limited compared with that in annual and 10-year returns, suggesting that, with intergenerational programs for sharing risk, equity retains considerable promise for helping savers meet their objectives for building wealth for retirement.

Endnotes

- 1 Arnott (2009) and Arnott and Berstein (2002) contend that this equity premium has been smaller, perhaps not even positive.
- 2 See Siegel (2008). Although the standard deviation of the average return on stocks falls with time, the standard deviation of wealth rises. This is the fallacy of time diversification discussed by Samuelson (1963) and Bodie (1995). Those who find stocks too risky for the short run also should find them too risky for the long run, unless their prices revert to a trend. See also Liu and Colman (2009) regarding the effect of repeated choices on investors' aversion to loss and ambiguity.
- 3 If returns are independently, identically distributed random variables, then the standard deviation of the average return for n periods equals the standard deviation for one period divided by the square root of n . Consequently, the standard deviation of annual returns from 1949 to 2008, 18.2 percentage points, implies that the standard deviation of average returns for 10-year intervals should be 5.8 percentage points if annual returns are identically, independently distributed. But the standard deviation of the average returns for the six decades, 9.3 percentage points, is almost twice this result.
- 4 As a result, analysis has resorted to autoregressions, assumptions of heteroscedasticity, Levy distributions, jump-diffusions, fractal models, chaos theory, and a variety of other techniques to describe the behavior of returns instead of the venerable random walk. For example, see Hull (2008); Calvet and Fischer (2002); Bouchaud (2005); and Gatheral (2006).
- 5 When investors become more uncertain about future returns as a result of changing business conditions, the risk in forecasts and, therefore, the variation in valuations which depend on the risk in forecasts can exceed the variation in historical returns (Pastor and Stambaugh 2009).
- 6 In other words, the market capitalization of corporations, GDP, and corporate earnings are cointegrated with error correction.

7 The market value of equity for nonfinancial corporations is reported in the Federal Reserve's Flow of Funds Accounts (2009), Table L.102. Earnings equal the sum of three components: 1) nonfinancial corporations' profits after tax with IVA and CCAdj, *National Income and Product Accounts* (2009), Table I.14; 2) the rate of change in the business output deflator, *National Income and Product Accounts*, Table I.3.4, times the net credit market liabilities of nonfinancial corporations; and 3) foreign earnings retained abroad, Flow of Funds, Table F.102.

8 The output of nonfinancial corporations represents about 70 percent of business output, which accounts for about three-quarters of GDP. The remainder of GDP represents the value of output attributed to households, nonprofit institutions, and general government (*National Income and Product Accounts*, Table I.3.5). Figure 1 shows that the value of equity for all corporations, financial plus nonfinancial, generally moves in concert with that of nonfinancial corporations alone.

About one-quarter of the output of nonfinancial corporations has represented the compensation of capital – earnings plus interest paid to creditors plus capital consumption expenses – and earnings after taxes have accounted for about one-third of capital's compensation, about 8 percent of nonfinancial corporations' output. The dominant component of earnings is profits after tax. From the *National Income and Product Accounts*, Table I.14, capital's share equals the sum of net operating surplus and capital consumption divided by gross value added ((lines 24+18) / line 17). Earnings' share of the compensation of capital equals profits after tax with IVA and CCAdj divided by the sum of net operating surplus and capital consumption (line 29 / (lines 24+18)). And earnings' share of output is profits after tax with IVA and CCAdj divided by gross value added (line 29 / line 17). The data cited reflect averages of these ratios for annual data, 1950 to 2008. This stability in capital's share of output provides the foundation for the time-tested Cobb-Douglas production function, much of the macroeconomic analysis of potential GDP, and the pricing of capital and labor inputs in equilibrium (Romer 2001).

9 This negative correlation, -0.7, is consistent with diminishing returns to capital in production functions.

10 Bodie, Kane, and Marcus (2008); Kopcke and Rutledge (2004); and Kopcke (2005).

11 MacKay (2009); Chancellor (2000); Kindleberger (2000); and Akerlof and Shiller (2009).

12 See Appendix Table for more detailed data on the contributions of earnings and valuations to equity values over time.

References

- Akerlof, George A. and Robert J. Shiller. 2009. *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*. Princeton, NJ: Princeton University Press.
- Arnott, Robert. 2009. "Bonds: Why Bother?" *Journal of Indexes* May/June: 1-5.
- Arnott, Robert and Peter Bernstein. 2002. "What Risk Premium is 'Normal'?" *Financial Analysts Journal* 58(2): 64-85.
- Bodie, Zvi. 1995. "On the Risk of Stocks in the Long Run." *Financial Analysts Journal* 51(3): 18-22.
- Bodie, Zvi, Alex Kane, and Alan Marcus. 2008. *Investments*. New York, NY: McGraw-Hill/Irwin.
- Bouchaud, Jean-Philippe. 2005. "The Subtle Nature of Financial Random Walks." *Chaos* 15(026104): 1-10.
- Calvet, Laurent and Adlai Fischer. 2002. "Multifractality in Asset Returns: Theory and Evidence." *The Review of Economics and Statistics* 84(3): 381-406.
- Chancellor, Edward. 2000. *Devil Take the Hindmost: A History of Financial Speculation*. New York, NY: Plume.
- Gatheral, Jim. 2006. *The Volatility Surface*. Hoboken, NJ: John Wiley & Sons, Inc.
- Hull, John C. 2008. *Options, Futures, and Other Derivatives*. 7th ed. Upper Saddle River, NJ: Prentice Hall.
- Ibbotson Associates. 2009. *Ibbotson Stocks, Bonds, Bills, and Inflation Classic Yearbook*. Chicago, IL: Morningstar.
- Kindleberger, Charles P. 2000. *Manias, Panics, and Crashes: A History of Financial Crises*. 4th ed. Hoboken, NJ: John Wiley & Sons, Inc.
- Kopcke, Richard W. 2005. "The Taxation of Equity, Dividends, and Stock Prices." Public Policy Discussion Papers 05-1. Boston, MA: Federal Reserve Bank of Boston.
- Kopcke, Richard W. and Matthew S. Rutledge. 2004. "Stock Prices and the Equity Premium During the Recent Bull and Bear Markets." *New England Economic Review* First Quarter: 82-84.
- Liu, Hsin-Hsien and Andrew M. Colman. 2009. "Ambiguity Aversion in the Long Run: Repeated Decisions under Risk and Uncertainty." *Journal of Economic Psychology* 30(3): 277-284.
- Lux, T. 1998. "The Socio-Economic Dynamics of Speculative Markets." *Journal of Economic Behavior and Organization* 33: 143-165.
- MacKay, Charles. 2009. *Extraordinary Popular Delusions and the Madness of Crowds*. Wilder Publications.
- Pastor, Lubos and Robert F. Stambaugh. 2009. "Are Stocks Really Less Volatile in the Long Run?" SSRN.com, abstract 1136847. February.
- Romer, David. 2001. *Advanced Macroeconomics*. New York, NY: McGraw-Hill.
- Samuelson, Paul A. 1963. "Risk and Uncertainty: A Fallacy of Large Numbers." *Scientia* 98: 108-113.
- Siegel, Jeremy J. 2008. *Stocks for the Long Run*. 4th ed. New York, NY: McGraw-Hill.
- U.S. Board of Governors of the Federal Reserve System. 2009. *Flow of Funds Accounts of the United States*. (June 11 Release). Washington, DC.
- U.S. Bureau of Economic Analysis. 2009. *National Income and Product Accounts*. Washington, DC.

APPENDIX

APPENDIX TABLE. ANNUAL NOMINAL APPRECIATION ON EQUITY OF NONFINANCIAL CORPORATIONS:
CONTRIBUTION OF EARNINGS AND VALUATIONS

Year	Trend value: constant earnings ratio and valuation ratio		Derived value: constant valuation ratio		Actual Value: market value of nonfinancial corporations	
	Average app. (1)	Std. dev. (2)	Average app. (3)	Std. dev. (4)	Average app. (5)	Std. dev. (6)
1949-2008	6.8 %	3.5 %	6.9 %	20.7 %	8.0 %	17.4 %
1949-1958	5.8	5.9	4.0	20.2	13.2	14.8
1959-1968	6.8	2.4	8.5	9.6	10.0	12.4
1969-1978	9.9	2.7	8.2	31.1	0.2	22.4
1979-1988	8.1	2.4	8.9	18.9	11.6	12.8
1989-1998	5.5	0.9	6.2	9.2	15.7	14.5
1999-2008	4.7	1.8	5.8	29.3	-1.1	22.8

Sources: U.S. Board of Governors of the Federal Reserve System (2009); and U.S. Bureau of Economic Analysis (2009).

The volatility of stock prices can be attributed to GDP, earnings, and valuations. If both the earnings and valuation ratios were constant, stock prices would vary only with GDP. In this case, the standard deviation for the annual appreciation of stock prices would have been only 3.5 percent from 1949 to 2008 (column 2). And, the average appreciation of stock prices would have been relatively stable during each of the six distinct decades since 1949 (column 1).

If the valuation ratio alone were constant, stock prices would reflect the volatility of annual earnings. Because annual earnings varied much more than GDP, the standard deviation of annual stock prices in this case, 20.7 percent, is much greater than in the previous case (column 4 versus column 2). Yet, because earnings reverted to trend relatively quickly and consistently, the annual variations of stock prices based on earnings would have largely “averaged out” in each of the six distinct decades since 1949 (column 3). The volatility of these 10-year average rates of appreciation matches that of stock prices based on GDP (column 1).

Actual annual stock prices are nearly as volatile as those derived in the previous case (column 6 versus column 4). But, the actual average rates of appreciation of stocks in each of the six distinct decades since 1949 are much more volatile than those derived in the previous cases (column 5 versus columns 1 and 3). This greater volatility reflects large and lasting variations in the valuation ratio rather than variations in GDP and earnings.

The annual volatility of stock prices that incorporates the variation in the earnings ratio (column 4) is generally greater than the annual volatility of stock prices that incorporates the net variation in both the earnings and valuation ratios. Even though the valuation ratio is more volatile than the earnings ratio, the annual percentage change in the valuation ratio is negatively correlated with the annual percentage change in the earnings ratio. As a result of this negative correlation, annual variations in the valuation ratio tend to offset a portion of the annual variations in the earnings ratio. Over periods longer than a year, this correlation between valuation and earnings ratios drops to zero. As earnings revert to trend relatively quickly, the persistent changes in valuations account for most of the variation in the average appreciation rates of stocks over periods as long as 10 years.

CENTER FOR
RETIREMENT
RESEARCH
AT BOSTON COLLEGE

About the Center

The Center for Retirement Research at Boston College was established in 1998 through a grant from the Social Security Administration. The Center's mission is to produce first-class research and forge a strong link between the academic community and decision makers in the public and private sectors around an issue of critical importance to the nation's future.

To achieve this mission, the Center sponsors a wide variety of research projects, transmits new findings to a broad audience, trains new scholars, and broadens access to valuable data sources. Since its inception, the Center has established a reputation as an authoritative source of information on all major aspects of the retirement income debate.

Affiliated Institutions

The Brookings Institution
Massachusetts Institute of Technology
Syracuse University
Urban Institute

Contact Information

Center for Retirement Research
Boston College
Hovey House
140 Commonwealth Avenue
Chestnut Hill, MA 02467-3808
Phone: (617) 552-1762
Fax: (617) 552-0191
E-mail: crr@bc.edu
Website: <http://www.bc.edu/crr>

The Center for Retirement Research thanks AARP, AIM Investments, Bank of America, ING, MetLife, Nationwide Mutual Insurance Company, Prudential Financial, State Street, TIAA-CREF Institute, and T. Rowe Price for support of this project.

© 2009, by Trustees of Boston College, Center for Retirement Research. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that the authors are identified and full credit, including copyright notice, is given to Trustees of Boston College, Center for Retirement Research.

The research reported herein was supported by the Center's Partnership Program. The opinions and conclusions expressed are solely those of the authors and do not represent the opinions of the partners or the Center for Retirement Research at Boston College.